# Improving Environmental Benefits Analysis

# In Ecosystem Restoration Planning

*by*

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**http://www.iwrusace.army.mil/iwr/ecosystem/enviro benefits.htm**

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# Fundamental Considerations:

- **Development of:**

  **> An evaluation philosophy and framework**

  **> Complementary analytical tools**

- **Relevant ecological and economic concepts**

- **Suitability of existing planning models and methods**

# SPECIFIC CONSIDERATIONS:

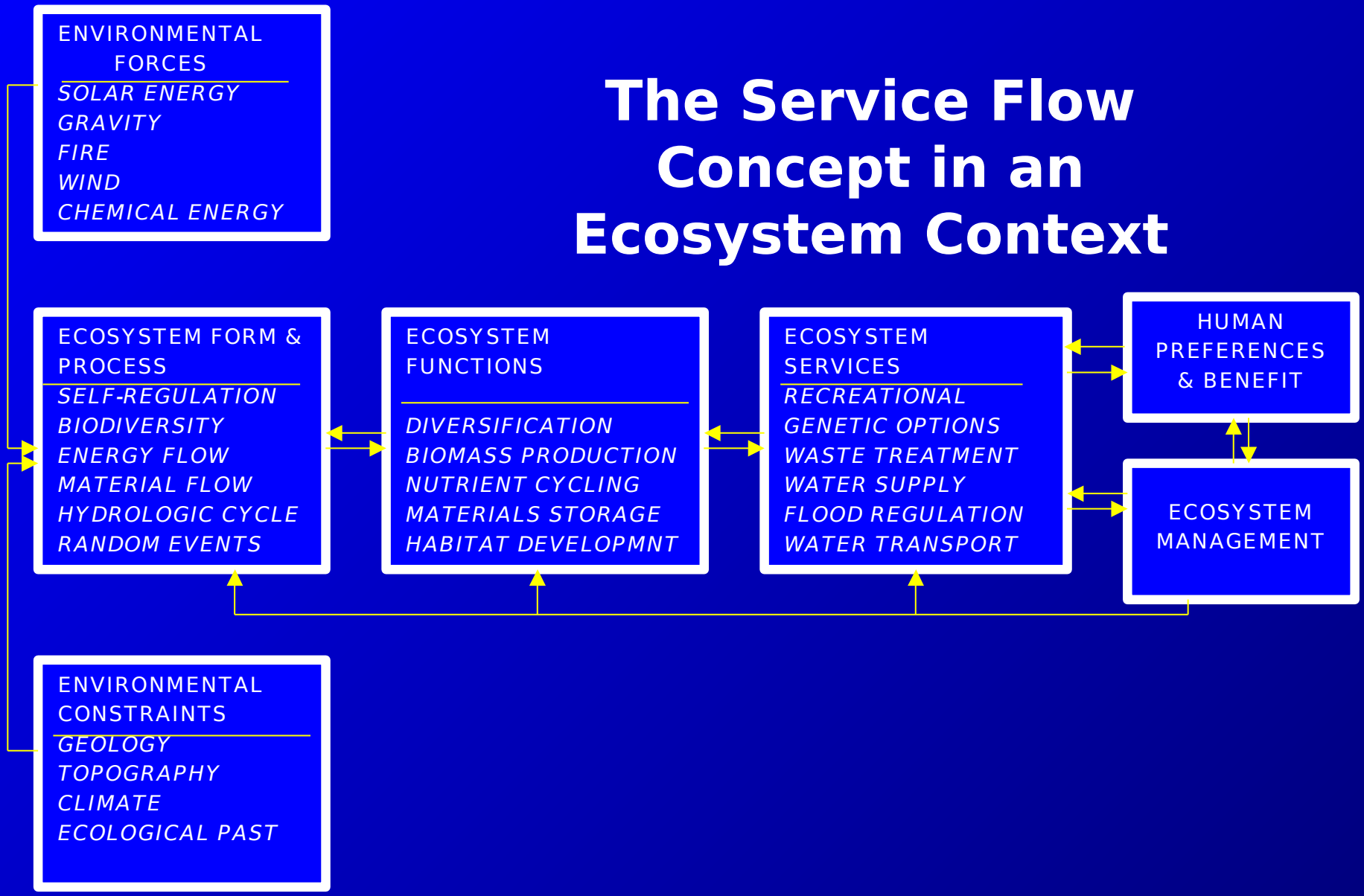
- **Analytical frameworks for NER and joint NED/NER projects**
  - **> The objectives of ecosystem restoration**
  - **> Characteristics of acceptable NER outputs**
- **Whether existing plan comparison frameworks are adequate**
- **What nonmonetary metrics may have**

# STUDY RESULTS

# RELEVANCE OF ECOSYSTEM SERVICES:

- Planning requires a standard of value to measure outcomes.
- The standard of value follows from the planning objective
- NED objective satisfies human wants
  - as indicated by economic benefit.
- Ecosystem services are conditions that "fulfill human life"
- NED outputs can be viewed as "ecosystem services"

# The Service Flow Concept in an Ecosystem Context



# RELEVANCE OF SERVICE CONCEPT TO NER:

- The relevance of services to NER is less clear.
- The objective for ecosystem restoration is:
  - to increase *desired* ecosystem *resources*
  - to result in a less degraded, *more natural condition*.
- Service relevance depends on the desired ends
- At least two motives for restoration can be identified:

# OF THE TWO MOTIVES:

- **Naturalness places value on removing human effect**
  - **> Specific resources & services are unimportant**
  - **> Implicit is benefit from more natural outputs**
- **Specific service places great value on resource effect**

# BOTH MOTIVES ARE REFLECTED IN POLICY:

- Restoration objectives include elements of both:
  - a *more natural*, or naturalistic, condition
  - *significant* ecosystem structure & function

- **And…** Environmentally *sustainable* results

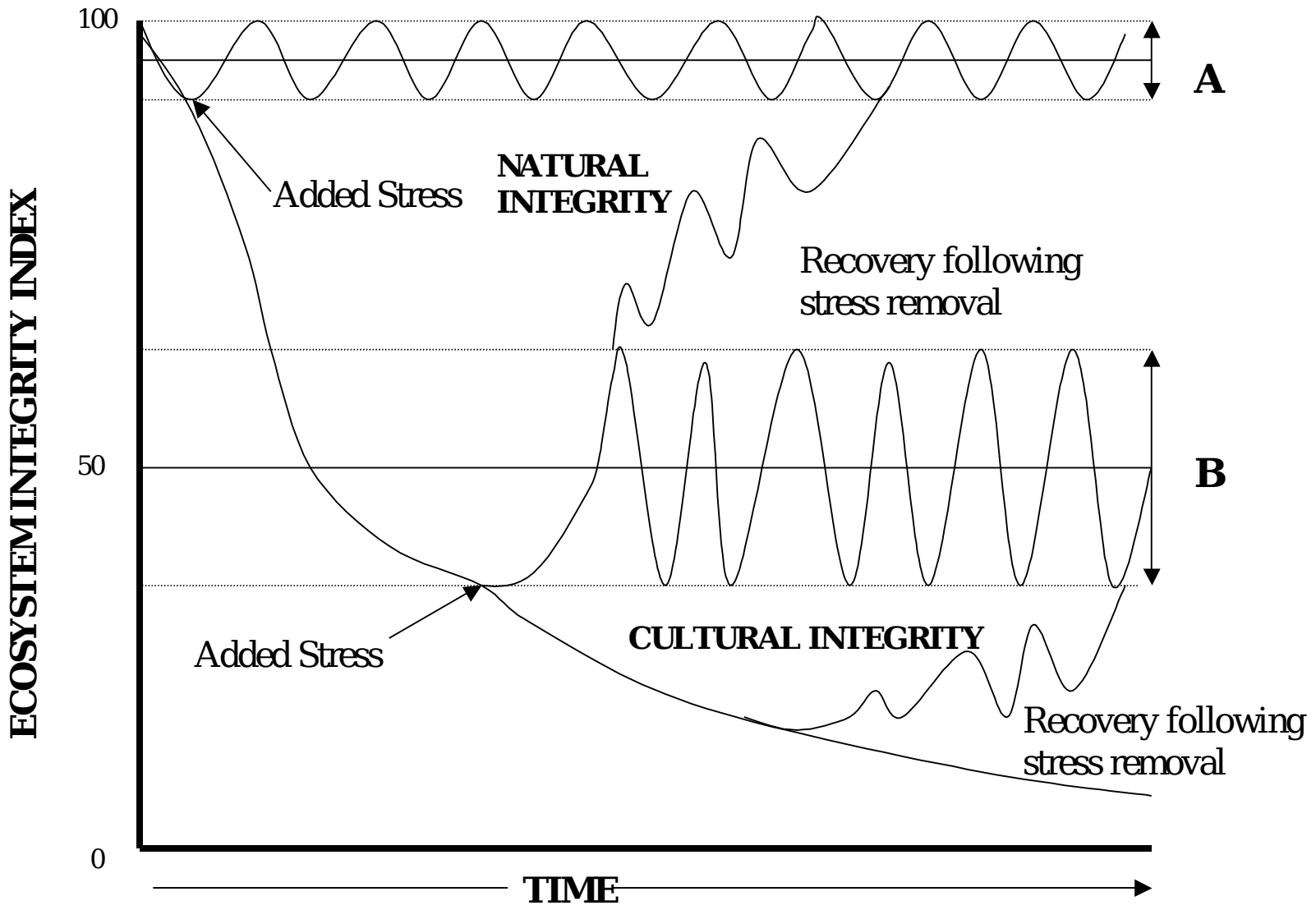
- Policy is unclear about relationships and priority of:

# THE CONCEPT OF A MORE NATURAL CONDITION:

- **Ecosystem naturalness is characterized by *natural integrity*.**
- ***Native biodiversity* is the measure of ecosystem integrity**
- **Integrity is the completeness of structure and function.**
- **Integrity is defined from real world references & human effect**
- **Fully natural is without human effect—but this is “relative”**

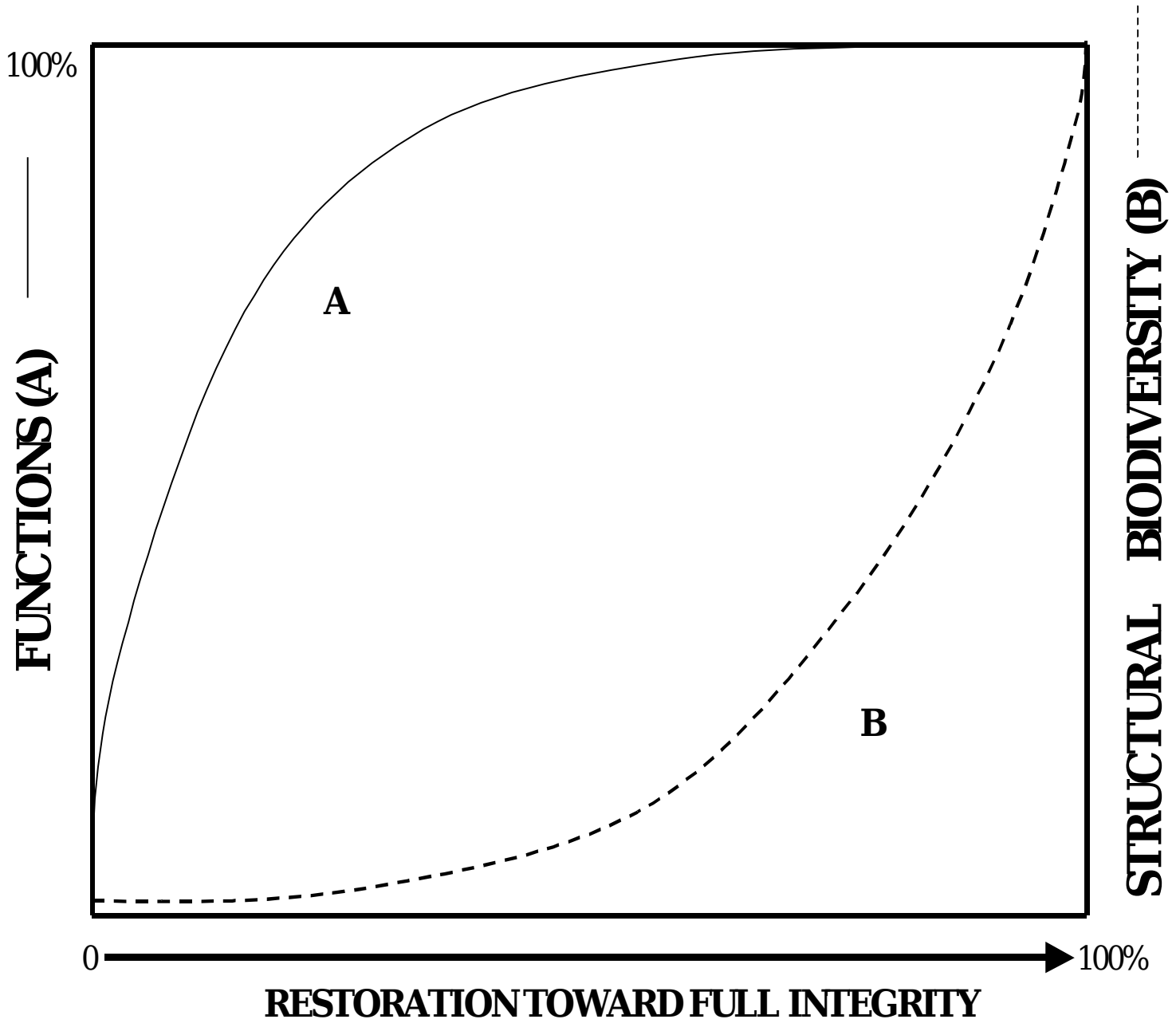
# THE ECOLOGICAL CONCEPT OF SUSTAINABILITY:

- Sustainability is linked with natural integrity
- Sustainability is long-term maintenance of:
  - > ecological structure and function
  - > when exposed to *evolutionary conditions.*
- Sustainability is about ecosystem *change* in the natural state
- Sustainability is in the entire ecosystem; not some portion
- Site changes are often "catastrophic" (e.g.,flood, storm), but:
  - > do not risk loss of ecosystem parts and processes
  - > sustains parts and process through natural process.
- Local species come and go while functions change less.
- Local ecosystem services are not 100 percent reliable
- Service reliability decreases as natural integrity decreases


100
50
0
ECOSYSTEM INTEGRITY INDEX
A
B
Added Stress
NATURAL INTEGRITY
Recovery following stress removal
Added Stress
CULTURAL INTEGRITY
Recovery following stress removal
TIME

# ECOLOGICAL RESOURCES & SERVICE:

- Ecosystem resources are living organisms and support system
- Scarce eco-resources sustain services most vulnerable to loss
- A keystone service of scarce eco-resources is maintenance of:
  - > unique genetic information ("architectural blueprints")
  - > future eco-service and eco-resource management options
- Common eco-resources dominate


100%
FUNCTIONS (A)
A
B
STRUCTURAL BIODIVERSITY (B)
0
100%
RESTORATION TOWARD FULL INTEGRITY

# RESTORATION PLANNING MODELS:

- None of the commonly used models were designed for NER
- Models vary in capacity for complexity & communication
  - >The number of outputs (objectives and attributes)
  - >Treatment of resource scale, naturalness, sustainability
  - >The explicitness of output metrics (index vs actual estimate)
- Index models can be useful in many settings but have limits

# MULTI-PURPOSE NER/NED PROJECTS:

- No monetary metric for all project effects is accepted
- No nonmonetary metric for all project effects is accepted
- Current NED/NER policy recognizes this reality
- The cost-effectiveness analytical framework is useful

  > even for multiple, non-commensurate metrics

  > even for joint NER/NED planning

# BUT :

- Analytical complexity grows as # of measures increase
- The NED measure is already inclusive
- Pursuit of more inclusive NER metrics is most relevant.

# BIODIVERSITY SCARCITY(SECURITY) INDEX (BSI):

- A BSI may be a good NER metric based on:
  - > vulnerability to global extinction and loss of integrity
  - > uniqueness reflected in taxonomic classification
- Communities with high BSI are ranked higher than low BSI
  - > works well in a portfolio for programmatic planning
  - > subjective determination of significance in a project setting